

Estimation of gender using cheiloscopy and dermatoglyphics

ABSTRACT

Background and Objective: Forensic dentistry plays a vital role in detection and resolution of crime, civil proceedings and personal identification. With ever-increasing demands placed upon law enforcement to provide sufficient physical evidence linking a perpetrator to a crime, it makes sense to utilize any type of physical characteristic to identify a suspect of an offense. The least invasive and cost-effective procedure among all methods of human identification is the study of lip prints and fingerprints. This study is done to determine the predominant pattern of fingerprint and lip print in males and females and to correlate it for gender identification.

Materials and Methods: The study sample comprised 100 individuals (50 males and 50 females) aged between 20 and 50 years; dark-colored lipstick was applied uniformly on the lips. The glued portion of cellophane tape was dabbed first in the center and then pressed uniformly over the corner of lips. Cellophane tape was then stuck to a white chart sheet for the purpose of permanent record. Lip print patterns were analyzed following the classification of Suzuki and Tsuchihashi. The imprint of left thumb was taken on a white chart sheet using a blue ink stamp pad and visualized using magnifying lens. Fingerprints were analyzed by following the classification given by Kücken. Correlation of lip print and fingerprint was analyzed using Chi-square test.

Results: The overall correlation of lip prints with fingerprints in males revealed branched lip pattern associated with whorl fingerprint and in females as vertical lip print pattern associated with loop fingerprint.

Conclusion: We conclude that the study between lip print and fingerprint can aid in gender determination.

Keywords: Cheiloscopy, dermatoglyphics, fingerprint, lip print, sex determination

INTRODUCTION

Forensic dentistry plays a vital role in detection and resolution of crime, civil proceedings and personal identification.^[1] Forensic odontology or forensic dentistry was defined by Keiser-Neilson in 1970 as “that branch of forensic medicine which in the interest of justice deals with the proper handling and examination of dental evidence and with the proper evaluation and presentation of the dental findings.”^[2]

“Identity” is a set of physical characteristics, functional or psychic, normal or pathological, that defines an individual.^[3] With the ever-increasing demands placed upon law enforcement to provide sufficient physical evidence linking a perpetrator to a crime, it makes sense to utilize any type of physical characteristic to identify a suspect of an offense. There are many well-known implanted methods of human identification such as odontology, anthropometry,

fingerprints, cheiloscopy, DNA analysis, and other techniques that determine gender, approximate age, height, etc.^[4]

Among all, the least invasive and cost-effective procedure is the study of lip prints and fingerprints. “Lip prints are defined as the normal lines and fissures present in the form of wrinkles and grooves that are located in the

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transition zone of the human lip, between the inner labial mucosa and the outer skin, the examination of which is referred as cheiloscopy.^[1] Dermatoglyphics (ancient Greek, derma = skin, glyph = carving) is the term specified to the scientific study of fingerprints, first given by Harold Cummins in the year 1926.^[5] The term “fingerprint” predominantly means an impression of the epidermal ridges of the fleshy distal portion of a finger.^[1]

The uniqueness and permanence of lip prints and fingerprints makes it a reliable tool in gender determination. The present study aims to determine the predominant pattern of fingerprint and lip print and to correlate it for gender identification.

MATERIALS AND METHODS

The study sample comprised 100 individuals (50 males and 50 females) aged between 20 and 50 years; materials used were dark-colored lipstick, cellophane tape, white graph sheet, blue inked stamp pad, and magnifying lens. Study individuals were explained in detail about the study, and informed consent was obtained. After obtaining the consent, lip print impressions were made by uniform application of a dark-colored lipstick on the lips. The glued portion of cellophane tape was subsequently dabbed on lips, first in the center and then pressed uniformly over the corner of lips. Lip prints were traced in normal rest position of lips. A minimal pressure was maintained while making lip impression. Cellophane tape was then stuck to a white chart sheet for permanent record purpose.

While studying lip prints, each individual's lips were divided into four quadrants and were studied in a clockwise sequence starting from upper right quadrant to upper left to lower left and lower right quadrant. These lip prints were examined using magnifying glass, classified, and analyzed. The lip print patterns were analyzed following classification of Suzuki and Tsuchihashi^[6] as Type I vertical - cutlines or grooves that run

vertically across the entire lips, Type II branched - grooves that fork, Type III intersecting - grooves that intersect, Type IV reticular - grooves that are reticulate (netlike), and Type V - unidentified [Figure 1].

Fingerprint impression was made using left thumb. Individuals were asked to wash their hands with soap and water to remove any dirt or oil. The imprint of thumb was made on a white chart sheet using a blue ink stamp pad and was visualized using magnifying lens. Fingerprints were analyzed by following the classification given by Kücken^[7] as loop, arch, and whorl pattern [Figure 2].

Individuals with competent lips and intact fingertips were included in the study. Individuals with diseases of dermis, burns, and minor cuts on fingers, amputated fingers, and incompetent lips such as inflammation, trauma, malformation, deformity, surgical scars, and active lesions of lips were excluded from the study. Individuals with Type V – unidentified type – of lip prints are also excluded from the study and individuals with Type I are included in the study.

The data were compiled using MS Office Excel. Chi-square test was performed and $P \leq 0.05$ was considered as statistically significant. The statistical analyses were performed using SPSS software for Windows version 10.5 (SPSS Inc., Chicago, IL, USA).

RESULTS

A total of 50 males and 50 females were included in the study. Lip prints of each individual showed unique and different pattern. Lip prints did not consist simply of one type of groove alone but appeared as a mixture of varying types. Our result showed a predominance of branched type (26) of lip print in males followed by vertical type (14), reticular type (7), and intersecting type (3). The most common type



Figure 1: Different types of lip prints



Figure 2: Different types of fingerprints

of lip print observed in females was of vertical type (21) followed by reticular type (15), branched type (12), and intersecting type (2).

The most frequently observed fingerprint pattern in males was the whorl pattern (24) followed by loop pattern (19) and arch pattern (7). Most of the females (30) showed a predominance of loop pattern of fingerprint followed by whorl pattern (11) and arch pattern (9).

Our results showed a statistical significant ($P = 0.002$) correlation between branched lip pattern and whorl fingerprint in males. In females, vertical lip pattern associated with loop finger pattern showed a high statistical significance ($P = 0.007$).

DISCUSSION

Identification of an individual is one of the most important goals of forensic science.^[8] The use of conventional methods such as dactylography (study of fingerprints) and cheiloscopy (study of lip prints) is paramount importance since personal identification by other means such as DNA analysis is sophisticated and not available in rural areas of developing countries like India.^[9] Lip prints can be identified as early as 6th week of intrauterine life and remain same during the life of an individual. Lip prints recover even after trauma, inflammation, and diseases such as herpes and can be recognized without difficulty.^[10]

Among males in our study, the most common observed lip print was branched type, i.e., Type II.^[11,12] Although some studies found Type IV as the predominant pattern,^[1,13,14] others found Type I^[9] and Type III as the most common patterns.^[8,10,15,16]

In our study, the most commonly observed lip print pattern in females was vertical lip pattern, i.e., Type I which was in accordance with many studies,^[1,10,11,14-18] in contrary, some studies revealed Type II as the most common pattern.^[8,9,13]

While dividing the lip prints into four quadrants, all the four quadrants showed different patterns in 15 males and 14 females. Similar lip print patterns in all the four quadrants were noticed in 4 males and 3 females. Lip print patterns which appeared alike in three quadrants were seen in 6 males and 6 females whereas 25 males and 27 females presented with similar lip print patterns in two quadrants. These variations in lip print pattern were also observed by Nagrale *et al.*,^[15] while one of the studies revealed Type I as the predominant pattern in most of the quadrants in both males

and females.^[19] In our study, two or more than two quadrants having the similar pattern of lip prints were considered for each mentioned pattern (according to the classification mentioned above).

Fingerprints are characterized by alternating strips of raised friction ridges and grooves that form peculiar and specific patterns. These patterns start to develop between the 5th and 6th week of intrauterine life and are fully formed by 21st week. Fingerprints or friction ridges are the prime and infallible means of identification in forensic investigations and trials.^[5]

In our study, the most frequently observed fingerprint pattern was the loop pattern as observed in few studies.^[1,3,5,9] Although males mostly presented whorl fingerprint pattern, females mostly presented loop fingerprint pattern.^[20] Furthermore, arch pattern was the least observed in both the genders in our study which is similar to other studies.^[3,5]

While comparing the significance of fingerprint and lip print pattern in males, the results revealed branched lip pattern with whorl fingerprint to be significant. This finding was contrary to 10.

Nagasupriya *et al.*^[11] in females the comparison of lip print and fingerprint pattern revealed vertical lip pattern with loop fingerprint to be highly significant. This finding was also contrary to Nagasupriya *et al.*^[11]

In our study, the overall correlation of lip prints with fingerprints for gender identification was found to be statistically significant as observed by Metgud *et al.*,^[21] in contrast, no correlation was seen in lip print and fingerprint by Murugan and Karikalan.^[9]

CONCLUSION

Although many studies have been done on fingerprints and lip prints alone for forensic investigation, very few studies have been done till now to correlate between fingerprints and lip prints. Correlation between lip prints and fingerprints in our study showed significant results. More studies with larger sample size can be done to serve in examination, diagnosis, and investigation of suspects which can be utilized in the act of criminal investigations and legal proceedings.

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Conflicts of interest

There are no conflicts of interest.

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